We claim:

1. A process for hydrogenating a monoolefinically unsaturated compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group to a saturated compound which bears the same at least two functional groups, in the presence of a rhodium-containing compound, as a catalyst, which is homogeneous with respect to the reaction mixture.

2. A process as claimed in claim 1, wherein the monoolefinically unsaturated compound used is a compound which is obtainable by adding two terminal olefins which bear the functional groups required to prepare the monoolefinically unsaturated compound containing at least two functional groups.

3. A process as claimed in claim 2, wherein the terminal olefins used are two olefins which each independently have the formula $H_2C=CHR^1$ in which R^1 is a nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group.

4. A process as claimed in claim 2 or 3, wherein the addition is carried out in the presence of a compound, as a catalyst,which is homogeneous with respect to the reaction mixture and contains rhodium, ruthenium, palladium or nickel.

5. A process as claimed in either of claims 2 or 3, wherein the addition is carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture and contains rhodium.

6. A process as claimed in either of claims 1 and 5, wherein the same rhodium-containing compound is used as a catalyst in the addition.

7. A process as claimed in claim 1, wherein the monoolefinically unsaturated compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group and carboxylic acid group is carboxylic ester group and carboxamide group is hexenedioic diester to obtain adipic diester in the hydrogenation.

8. A process as claimed in claim 1, wherein the monoolefinically unsaturated compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group is butenedinitrile to obtain adipodinitrile in the hydrogenation.

9. A process as claimed in claim 1, wherein the monoolefinically unsaturated compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group is 5-cyanopentenoic ester to obtain 5-cyanovaleric ester in the hydrogenation.

10. A process as claimed in any of claims 1 to 9, wherein the hydrogenation is carried out in the presence of a rhodium-containing compound, as a catalyst, which is homogeneous with respect to the reaction mixture and has the formula $[L^1RhL^2L^3R]^+X^-$ where

L^1 is an anionic pentahapto ligand;
L^2 is an uncharged 2-electron donor;
L^3 is an uncharged 2-electron donor;
R is selected from the group consisting of H, C_1-C_{10}-alkyl, C_6-C_{10}-aryl and C_7-C_{10}-aralkyl ligands;
X^- is a noncoordinating anion;

and where two or three of L^2, L^3 and R are optionally joined.

11. A process as claimed in claim 10, wherein L^1 is pentamethylcyclopentadienyl.

12. A process as claimed in either of claims 10 and 11, wherein X^- is selected from the group consisting of BF_4^-, $B(perfluorophenyl)_4^-$, $B(3,5\text{-}bis(trifluoromethyl)phenyl)_4^-$, $Al(OR^F)_4^-$ where R^F is identical or different perfluorinated aliphatic or aromatic radicals.

13. A process as claimed in any of claims 10 to 12, wherein L^2 and L^3 are each independently selected from the group consisting of C_2H_4, $CH_2{=}CHCO_2Me$, $P(OMe)_3$

and MeO_2C-(C_4H_6)-CO_2Me.

14. A process as claimed in any of claims 10 to 13, wherein L^2 and L^3 together are selected from the group consisting of acrylonitrile and 5-cyanopentenoic ester.

15. A process as claimed in any of claims 10 to 14, wherein L^2 and R together are $-CH_2-CH_2CO_2Me$.

16. A process as claimed in any of claims 10 to 15, wherein L^2, L^3 and R together are $MeO_2C(CH_2)_2$-(CH)-$(CH_2)CO_2Me$.

17. A process as claimed in claim 10, wherein the hydrogenation is carried out in the presence of a rhodium-containing compound, as a catalyst, which is homogeneous with respect to the reaction mixture and is selected from the group consisting of

$[Cp^*Rh(C_2H_4)_2H]^+ BF_4^-$,
$[Cp^*Rh(P(OMe)_3)(CH_2=CHCO_2Me)(Me)]^+ BF_4^-$,
$[Cp^*Rh(-CH_2-CH_2CO_2Me)(P(OMe)_3)]^+ BF_4^-$,
$[Cp^*Rh(MeO_2C(CH_2)_2-(CH-)-(CH_2)CO_2Me)]^+ BF_4^-$,
$[Cp^*Rh(C_2H_4)_2H]^+$ B(3,5-bis(trifluoromethyl)phenyl)$_4^-$,
$[Cp^*Rh(P(OMe)_3)(CH_2=CHCO_2Me)(Me)]^+$ B(3,5-bis(trifluoromethyl)phenyl)$_4^-$,
$[Cp^*Rh(-CH_2-CH_2CO_2Me)(P(OMe)_3)]^+$ B(3,5-bis(trifluormethyl)phenyl)$_4^-$,
$[Cp^*Rh(MeO_2C(CH_2)_2-(CH-)-(CH_2)CO_2Me)]^+$ B(3,5-bis(trifluoromethyl)phenyl)$_4^-$,
$[Cp^*Rh(C_2H_4)_2H]^+$ B(perfluorophenyl)$_4^-$,
$[Cp^*Rh(P(OMe)_3)(CH_2=CHCO_2Me)(Me)]^+$ B(perfluorophenyl)$_4^-$,
$[Cp^*Rh(-CH_2-CH_2CO_2Me)(P(OMe)_3)]^+$ B(perfluorophenyl)$_4^-$,
$[Cp^*Rh(MeO_2C(CH_2)_2-(CH-)-(CH_2)CO_2Me)]^+$ B(perfluorophenyl)$_4^-$
$[Cp^*Rh(C_2H_4)_2H]^+ Al(OR^F)_4^-$,
$[Cp^*Rh(P(OMe)_3)(CH_2=CHCO_2Me)(Me)]^+ Al(OR^F)_4^-$,
$[Cp^*Rh(-CH_2-CH_2CO_2Me)(P(OMe)_3)]^+ Al(OR^F)_4^-$ and
$[Cp^*Rh(MeO_2C(CH_2)_2-(CH-)-(CH_2)CO_2Me)]^+ Al(OR^F)_4^-$,

where R^F is identical or different perfluorinated aliphatic or aromatic radicals.

18. A process as claimed in any of claims 1 to 17, wherein the hydrogenation is carried out at a partial hydrogen pressure in the range from 0.1 bar to 200 bar.

19. A process as claimed in any of claims 1 to 18, wherein the hydrogenation is carried out at an average mean residence time of the monoolefinically unsaturated compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group which is in the range from 0.1 to 100 hours.

20. A process as claimed in any of claims 1 to 19, wherein the hydrogenation is carried out at a temperature in the range from 30°C to 160°C.

21. A process as claimed in any of claims 1 to 20, wherein at least 5% of the monoolefinically unsaturated compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group is hydrogenated to a saturated compound which bears the same at least two functional groups.

22. A process as claimed in claim 5, wherein the mixture obtained in the addition is fed to a hydrogenation as claimed in any of claims 1 to 21 without removing the rhodium-containing compound used as a catalyst.